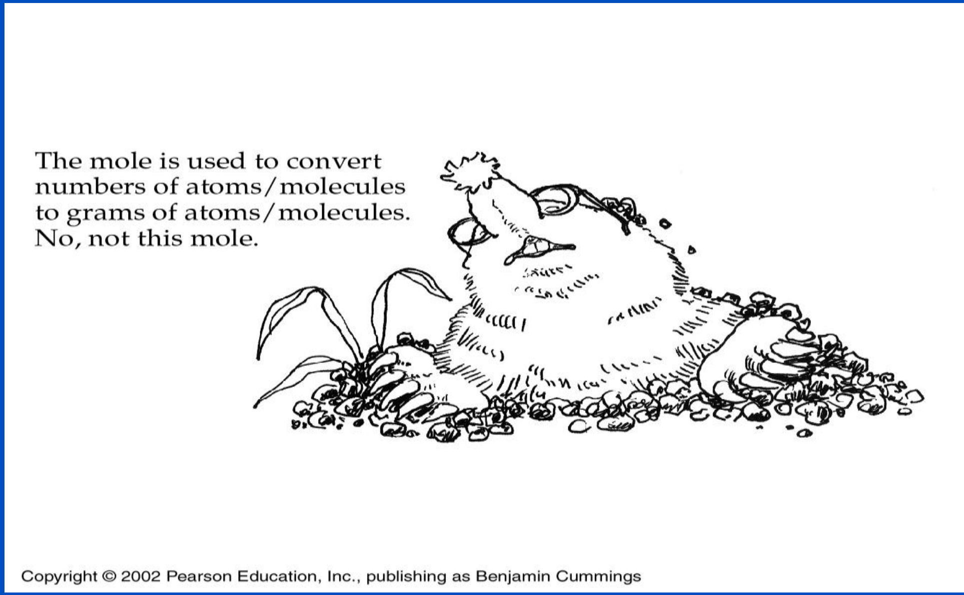
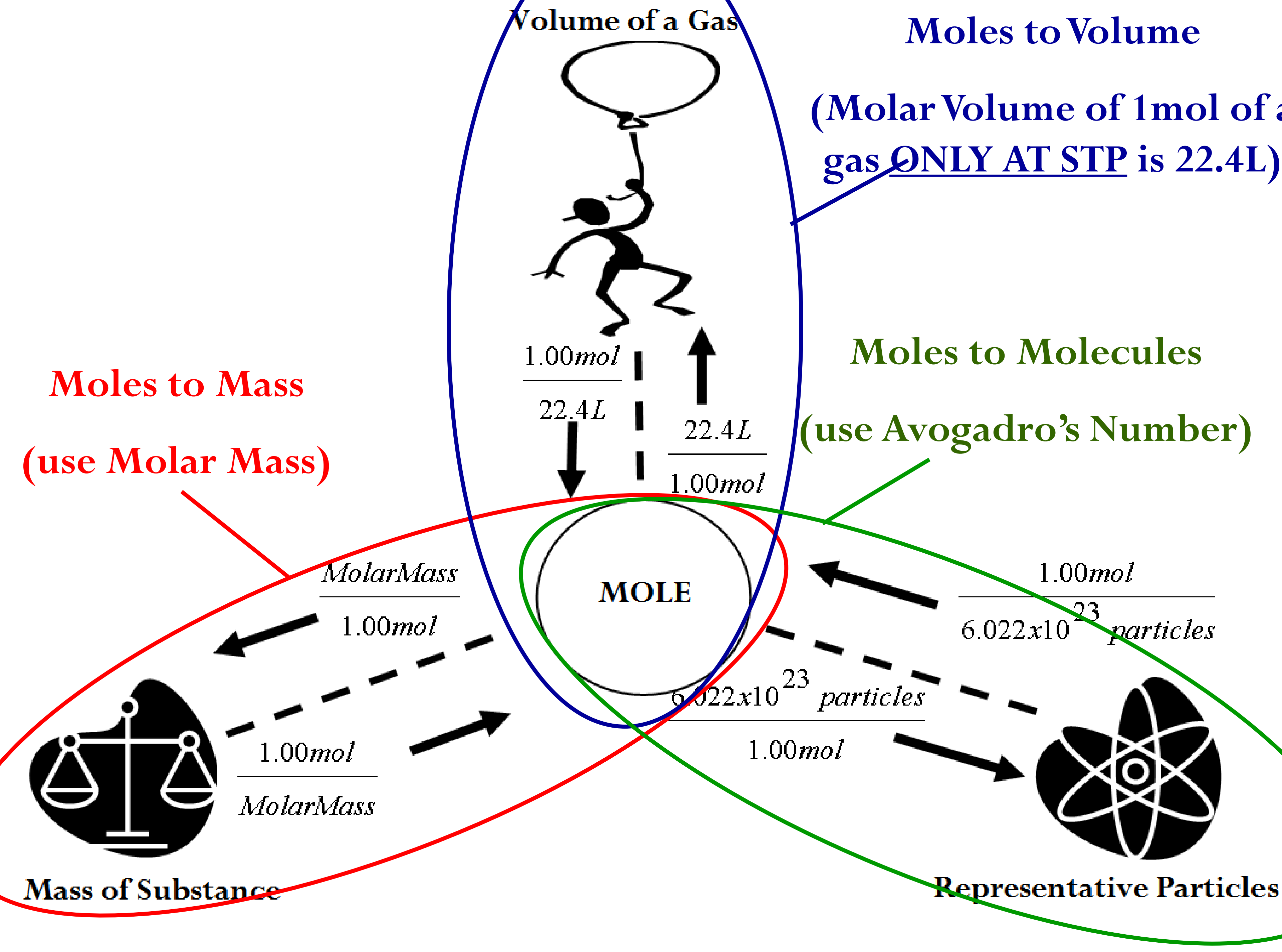
Stoichiometry Review



The Law of Conservation of Mass

- States that mass is neither created nor destroyed in any ordinary chemical reaction.
- Or more simply, the mass of substances produced (products) by a chemical reaction is always equal to the mass of the reacting substances (reactants).



Volume of a Gas
Moles to Volume
(Molar Volume of 1mol of a gas ONLY AT STP is 22.4L)
$\frac{1.00mol}{22.4L}$
$\frac{22.4L}{1.00mol}$
Moles to Molecules
(use Avogadro's Number)
Moles to Mass
(use Molar Mass)
MOLE
$\frac{MolarMass}{1.00mol}$
$\frac{1.00mol}{MolarMass}$
$\frac{1.00mol}{6.022x10^{23}\ particles}$
$\frac{6.022x10^{23}\ particles}{1.00mol}$
Mass of Substance
Representative Particles

Simple Conversions:

- Mole / Mass Conversions -

Use the Molar Mass of a substance to convert from Moles to Mass and Mass to Moles

Mass to Moles →

$$\frac{80.\ g\ CuSO_4}{} \left| \frac{1\ mol\ CuSO_4}{159.5\ g\ CuSO_4} \right. = 0.50\ mol\ CuSO_4$$

Moles to Mass →

$$\frac{0.50\ mol\ CuSO_4}{} \left| \frac{159.5\ g\ CuSO_4}{1\ mol\ CuSO_4} \right. = 80.\ g\ CuSO_4$$

Simple Conversions:

- Mole / Molecule Conversions -

Use Avogadro's Number : 6.022×10^{23} molecules (mc) in one mole of the substance

Moles to (mc) →

$$\frac{2 \text{ mol } CuSO_4}{} \left| \frac{6.022\times10^{23} \text{ (mc) } CuSO_4}{1 \text{ mol } CuSO_4} \right. = 1.2\times10^{24} \text{ (mc) } CuSO_4$$

(mc) to Moles →

$$\frac{1.2\times10^{24} \text{ (mc) } CuSO_4}{} \left| \frac{1 \text{ mol } CuSO_4}{6.022\times10^{23} \text{ (mc) } CuSO_4} \right. = 2 \text{ mol } CuSO_4$$

Simple Conversions:

- Mole / Volume Conversions -

At STP (standard temperature and pressure) one mole of any gas takes up 22.4 L of space

Moles to Volume →

$$\frac{2 \text{ mol } O_2}{} \left| \frac{22.4 \text{ L } O_2}{1 \text{ mol } O_2} \right. = 44.8 \text{ L } O_2$$

Volume to Moles →

$$\frac{44.8 \text{ L } O_2}{} \left| \frac{1 \text{ mol } O_2}{22.4 \text{ L } O_2} \right. = 2 \text{ mol } O_2$$

Mole Ratio

- If you are trying to convert from one material to another in a chemical equation, you must use the mole ratio which can be found in the balanced chemical equation

$$2\ Al + 3\ CuCl_2 \rightarrow 3\ Cu + 2\ AlCl_3$$

- The Mole Ratio for Aluminum to Copper is 2:3 meaning 2 moles of Al will produce 3 moles of Cu

Stoich Problem #1

- If 80 grams of copper (II) sulfate reacts with an excess of iron, how many grams of copper will be produced?

80 g $CuSO_4$	1 mol $CuSO_4$	1 mol Cu	63.5 g Cu
	159.5 g $CuSO_4$	1 mol $CuSO_4$	1 mol Cu

= 31.8 g Cu

Stoich Problem #2

- The base calcium hydroxide neutralizes 60 g nitric acid, how many g of salt will be produced?

60 g HNO_3	1 mol HNO_3	1 mol $Ca(NO_3)_2$	160 g $Ca(NO_3)_2$	= 76.2 g $Ca(NO_3)_2$
	63 g HNO_3	2 mol HNO_3	1 mol $Ca(NO_3)_2$	

Stoich Problem #3

- 2.0×10^{25} atoms of copper is reacted with an excess of a silver (I) nitrate solution, how many grams of silver are produced?

$$\frac{2.0\times10^{25}\ \text{(a) Cu}}{} \left| \frac{1\ \text{mol Cu}}{6.022\times10^{23}\ \text{(a) Cu}} \right| \frac{2\ \text{mol Ag}}{1\ \text{mol Cu}} \left| \frac{107.9\ \text{g Ag}}{1\ \text{mol Ag}} \right. = 7.17\times10^{3}\ \text{g Ag}$$

Stoich Problem #4

- An excess of methane gas combusts in the presence of 1.00 kL of oxygen, what volume of carbon dioxide will be produced at STP?

1.00 kL O_2	1000 L O_2	1 mol O_2	1 mol CO_2	22.4 L CO_2	= 500 L CO_2
	1 kL O_2	22.4 L O_2	2 mol O_2	1 mol CO_2	